

DATABASE SYSTEM, METHOD FOR FORMING  
REPLICA OF DATABASE, AND COMPUTER-READABLE  
RECORDING MEDIUM THAT RECORDS DATABASE REPLICA FORMING PROGRAM

5 BACKGROUND OF THE INVENTION

This invention relates to forming of a replica of a database in a database system.

As described in chapter 23, pp. 624 and pp. 630 of "An Introduction to Database Systems, Volume I, Fifth Edition" by  
10 C. J. Date, the replica of database means a replica that should be identical with the master database in the data content and management method. A replica is prepared for avoiding a risk of working interruption due to work distribution of data processing or due to a failure of a computer that stores the  
15 data. It is required that the data content is logically identical between the master database and the replica. In order to be identical, it is required to apply the same data update processing as applied to the master database also to the replica to thereby maintain the same content. Heretofore, in order to  
20 maintain the same content, the same data update processing as applied to the master database is applied to the replica in the order of the occurrence of the update processing to thereby reflect the update on the replica.

A conventional replica forming process flow and the data  
25 content of update information to be used are shown in FIG. 6.

When replica forming process is started (401), for example, the update information used for updating the stored master database called as journal or update log is read in the order of occurrence successively (402). The read update information is edited so as to be capable of reflecting on the replica side database (syntax or parameter format used to update the database), and then reflected on the replica side database (403). Whether there is any subsequent update information or not is determined (404), and if the result is YES, then the process is repeated.

10 When the update information reaches to the end of the stored update information, the sequence is brought to an end (405). The data content of the update information contains the update table name 501 that is the table name to be updated in the database, the type of update 502, and the record information 15 503 for indicating the updated record content. The table name is only an example, and the data element such as table, item, and record is the data content of the update information. The order of data of the update information data content of Fig. 6 is the same as the order of update that has occurred in the 20 master side database, and the update process of the replica occurs in the same order.

In the conventional art, the update process to be applied involves various tables (in other words, various data are mixed). Because update of the replica is applied in the same order as 25 applied actually in updating of the data even though usage and

necessity of the data are different respectively, it can occur that the necessary data is not reflected until all the stored update information is updated completely. For example, because update of another table is mixed during update of inventory table when the updated data of the inventory table is wanted in FIG. 6, it is not guaranteed that update of the inventory table has been completed until reflection of the update data is completed for all the update data. Therefore, it is a problem that it takes a long time to get the updated data that is required.

#### BRIEF SUMMARY OF THE INVENTION

In view of the above, it is the object of the present invention to get the updated data that is required preferentially out of various data correspondingly to the usage and necessity of the data.

In a database system having a master database and a replica thereof, the present invention involves reflection of the update information of the data on the replica not in the order of updating that has occurred in the master side but in the specified order of preference based on the purpose for using.

In detail, a memory unit for storing the order of preference of replica preparation process of a certain data type, an allocation processing unit for preferentially extracting the update data of the database correspondingly to the information, and a management unit for updating the replica successively in

the order according to the data extracted by means of the allocation processing means are provided.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

5           FIG. 1 is a block diagram illustrating one example of the present invention.

FIG. 2 is a flow chart describing a data allocation unit shown in FIG. 1.

10           FIG. 3 is a diagram illustrating an example of preferential order specification in the example of the present invention.

FIG. 4 is a block diagram illustrating another example of the present invention.

15           FIG. 5 is a diagram illustrating an example of the database content and an example of preferential order information of the present invention.

FIG. 6 is a flow chart describing a conventional replica preparation process and an example of the update information data content.

20           FIG. 7 is a diagram illustrating another example of the present invention.

#### DETAILED DESCRIPTION OF THE PRERERRED EMBODIMENTS

Embodiments of the present invention will be described  
25 hereinafter with reference to the drawings. FIG. 1 is a

structural diagram of a database system of the present invention.

A master side database management unit 1 that is a system for managing a master database processes a data update request

requested from a user, and updates a master DB 12 of a memory

unit 5. The log information that has been got before and after

updating is sent out to an update log file 13 when the data is

updated for accommodating the failure of the master DB. A

replica forming unit 3 reads an update log from the update log

file 13 of the master side database, and updates the replica

side database system. An update log reading unit 17 for reading

an update log stores a necessary update data out of the read

update logs in an update data cue 19.

A preferential order of the data, a replica of which is

to be prepared, is specified by a use by use of a terminal unit

key board. A preferential order acquiring unit 14 acquires the

preferential order of the data, and holds it in a preferential

order information memory unit 15 as the preferential order

information. A data allocation unit 16 receives the

preferential order information. The data allocation unit 16

reads out the information in the update data cue 19 successively

in the order of updating, extracts the update information in

the update data cue 19 in the order from the data type having

the highest preference, and sends it out to a data update request

unit 18. The data update request unit 18 sends out the received

update request to a replica side database management unit 2.

The replica side database management unit 2 reflects the update request received from the data update request unit 18 on a replica DB 61.

The type of the data to which a preferential order is specified means, for example, the update information of the inventory table or merchandise master table in FIG. 6, or, for example, the update information of further subdivided category such as merchandise category A or merchandise category B in the inventory table. The preferential order may involve two-class classification in which the data type is classified into the highest order and others, or may involve multi-class classification in which the data type is classified into the first preferential order, the second preferential order, and so on. In the case of the two-class classification, not an order number but a flag is added simply to indicate the highest preference to be updated first. Otherwise, the data type to be updated preferentially may be stored.

FIG. 2 shows a process flow implemented when the replica forming unit 3 determines the preferential order and allocates the data. It is assumed that the preferential order is specified in the database table unit. When a data allocation process is started (101), the preferential order information of the table having the highest preference out of unprocessed tables is read based on the specified preference specifying information (102). Next, the update information is read from

the update data cue 19 (103), and the determination is made whether the table name having the update information is identical with the table name of the preferential order height that is being processed (104). If YES result is obtained, the  
5 update information is selected and sent to the data update request unit (105), and the replica side database management unit 2 reflects the update data on the replica.

As described herein above, the process in which the update information is read in the order of updating and the update  
10 information having the corresponding preferential order is selectively extracted is referred to as allocation. While the determination is made whether it is the end of the update information or not (106), and the update information is read and the process is repeated until end of the stored update  
15 information comes. When the end comes, whether there is the table having the next preferential order or not is determined (107), if there is the table having the next preferential order, then the same process as performed in the case is performed on the table.

20 As described hereinabove, the data allocation unit 16 selects the stored update information from that of the highest preferential order and transfers it to the data update request unit 18 for updating of the replica, the database is updated from the specified update information having the highest  
25 preferential order in the replica. As the result, the updated

information having higher preferential order request for using in the replica is rendered available earlier.

FIG. 3 shows an exemplary specification of the preferential order. In this example, three tables, namely the inventory data table 201, merchandise master table 202, and market analysis table 203, are extracted from the tables that are components of the master side database, and the update information is reflected on tables having the same names on the replica side. In the preference specification, the extraction side table 212 and reflection side table 213 are specified, and the preferential order 214 is specified finally. The result is stored in the preferential order information memory unit 15. In this exemplary specification, the updating of the inventory data 204 has the highest preference, and the updating of the market analysis 206 has the lowest preference.

FIG. 4 shows an exemplary system structure in which the replica forming unit is provided on the master side database and on the replica side database, both replica forming units are connected each other through a communication means, and the respective replica forming units specify the preference order. The master side replica forming unit is referred to as data extraction unit 31 and the replica side replica forming unit is referred to as data reflection unit 4. These replica forming units are somewhat different from the replica forming unit shown in FIG. 1 in the structure. The data extraction unit 31 and



the data reflection unit 4 are disposed separately, and the data is transferred between the data extraction unit 31 and the data reflection unit 4 by use of a communication means such as network, wireless communication network, communication cable, or

5 optical communication network. A data allocation unit 16 of the data extraction unit 31 sends the allocated data to a data transfer unit 28 in the same manner as shown in FIG. 1 and FIG. 2. The data transfer unit 28 sends the transferred update information to a data receiving unit 41 of the data reflection unit 4 by use of the communication means 7, and stores the update information in the update data cue 42.

An example in which the replica forming units disposed separately are used will be described with reference to FIG. 3 and FIG. 5 hereinafter. The exemplary preference specification shown in FIG. 3 is used as the preference specification for the data extraction unit 31. The inventory data shown in FIG. 5 is an exemplary inventory data table stored in the database 12. The preference specification a and the preference specification b are different examples of the preference specification, and stored in a preferential order information memory unit 52. The necessity preference order of the data, namely the inventory data> the merchandise master> the market analysis, is set in the replica side system, and the preference order acquiring unit 14 of the data extraction unit 31 acquires the preference order.

The preference specification in the data reflection unit 4 is shown in FIG. 5. The preference specification a is an example in which the record that preferentially reflects the update information of the inventory data based on the

5 merchandise category 301 is selected. The preferential key condition 312 and the preferential order 313 that are to be referred now is specified out of the inventory data on the replica side to thereby not only preferentially specify the inventory data but also further subdivide the preferential order specification. Herein, the data is updated to the newest  
10 information for respective merchandise category data of the inventory data. According to the preferential order, because the merchandise category reflects the inventory of the merchandise A preferentially among the inventory data, the  
15 preferential reflection is used effectively when the inventory of the merchandise category A is to be checked during business negotiation.

The preference specification b shows an example in which a necessary item is reflected preferentially. When the  
20 database is used for other purpose such as data analysis, only the item that is necessary for analysis is reflected preferentially and the residual items are reflected later. As the result, the analysis can be started earlier and the earlier starting is effective in the case of the time-consuming analysis  
25 such as multidimensional analysis. In the preference

specification b, the preferential column 322 of the table of the inventory data is specified and the preferential order 323 is specified respectively to thereby reflect the merchandise category, merchandise code, and inventory preferentially.

5           Examples, in which the update data is extracted preferentially for the category including to the table name on the master side, and further subdivided preferential key condition is specified and the update data is extracted preferentially by specifying the preferential column of the  
10 table, are shown hereinbefore. According to the above, the database can be updated based on the subdivided preferential order and also the following effect is obtained. In detail, it is assumed that a plurality of data reflection units 4 and replicas are provided and only the inventory data is transferred  
15 from the data transfer unit 28 of the data extraction unit 31. A certain data reflection unit allocates the merchandise category A as the most preferential update data, and another data reflection unit allocates the merchandise category C as the most preferential update data. The replica is  
20 preferentially updated so as to satisfy different requests requested from users located on remote areas distant far from the master DB by employing the structure as described hereinabove.

          Furthermore, another example is described herein under.  
25 The preferential order acquiring unit 14, the preferential order

information memory unit 15, and the data allocation unit 16 of the data extraction unit 31 shown in FIG. 4 are removed or not used, and all update data are transferred to the data reflection unit 4 on the replica side through the communication means 7.

- 5 The allocation preferential order of the update data is determined only by means of the data reflection unit 4. Thereby, the master DB side load is reduced.

Another example, in which a plurality of data reflection units 4 and replicas are provided as shown in FIG. 4 and on the other hand the data extraction unit 31 extracts a plurality of types of update data in parallel, will be described herein under. The plurality of types of update data are transferred to different data reflection units 4 respectively by means of the data transfer unit 28. Thereby, the replica can be updated so as to satisfy the request of users located on remote areas.

FIG. 7 shows a diagram illustrating another example of the present invention. In this example, the replica side database management unit 2 has acquired the database reference history information, and the update information of the table of the database that has been referred most frequently is reflected preferentially on the replica. Therefore, the preferential order is specified not based on the user specification but based on the result of statistical processing of actual database reference history. Differently from the example shown in FIG. 4, what table of the replica has been

referred in the replica side database management unit 2 is transferred to the replica reference history acquiring unit 55, and the replica reference history acquiring unit 55 sets it to the preferential order information memory unit 52 as the

5 preferential order information. The data allocation unit 43 develops the update information on the data update request unit 44 by use of the information supplied from the preferential order information memory unit 52. Thereby, it is possible that the system judges the preferential order on which the update  
10 information is reflected according to the reference frequency of the replica side database used by users and the data of high reference frequency is reflected preferentially as the newest data.

According to the present invention, the update order is  
15 changed so that the more necessary data is updated earlier and less necessary data is updated later by means of the allocation unit. However, after all, the update data of all the data types is reflected on the replica in the same order as the update order of the master database. Some data type is updated earlier  
20 according the specified preferential order.

Examples in which the database holds the data in the form of table are described hereinbefore, but the present invention is by no means limited to the specified database type. The above-mentioned process is performed by means of a program in  
25 the examples. The program is recorded in a computer-readable

According to the present invention, it is possible to reflect the update information with selection of the data type, the replica of which is to be prepared preferentially

1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299</
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	--------